

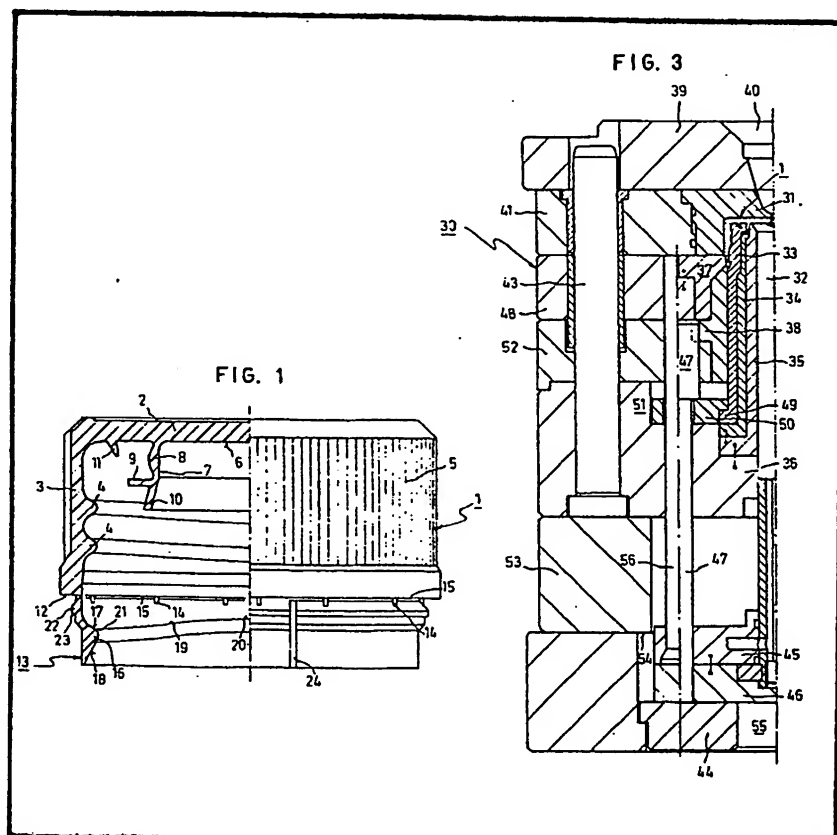
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(54) Moulded Tamperproof Screw Caps

(57) A plastics screw cap comprising a security ring 13 attached to spirit 3 by relatively weak connecting bridge portions 14 is provided with a pair of shoulders 12, 22, one of the surfaces of each being disposed substantially normal to the axis of the screw cap so

as to provide a pair of support surfaces for cooperation with stripping elements 37, 38, Figure 3, during ejection of the cap from injection mould 30, without producing stresses capable of rupturing the connecting bridge portions 14. Mould 30 is designed so as not to require mould members transversally moveable relative to the axis thereof for stripping operations.



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FIG. 1

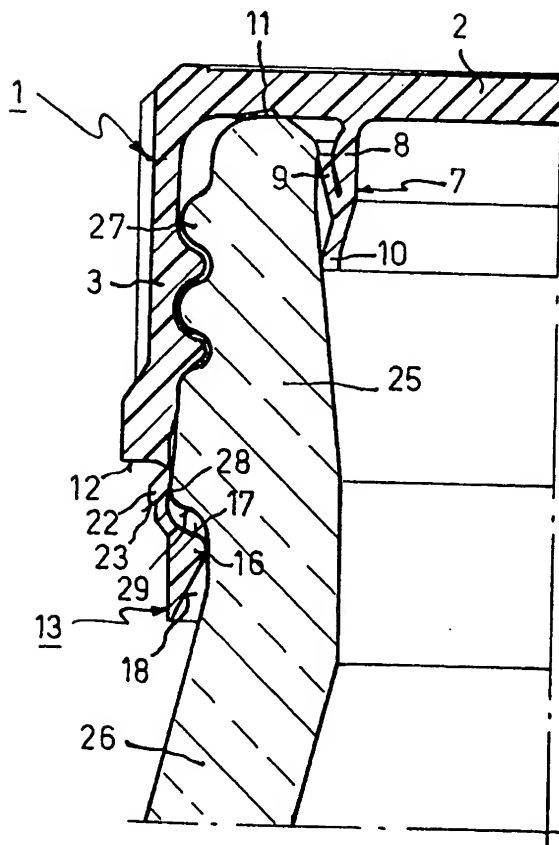
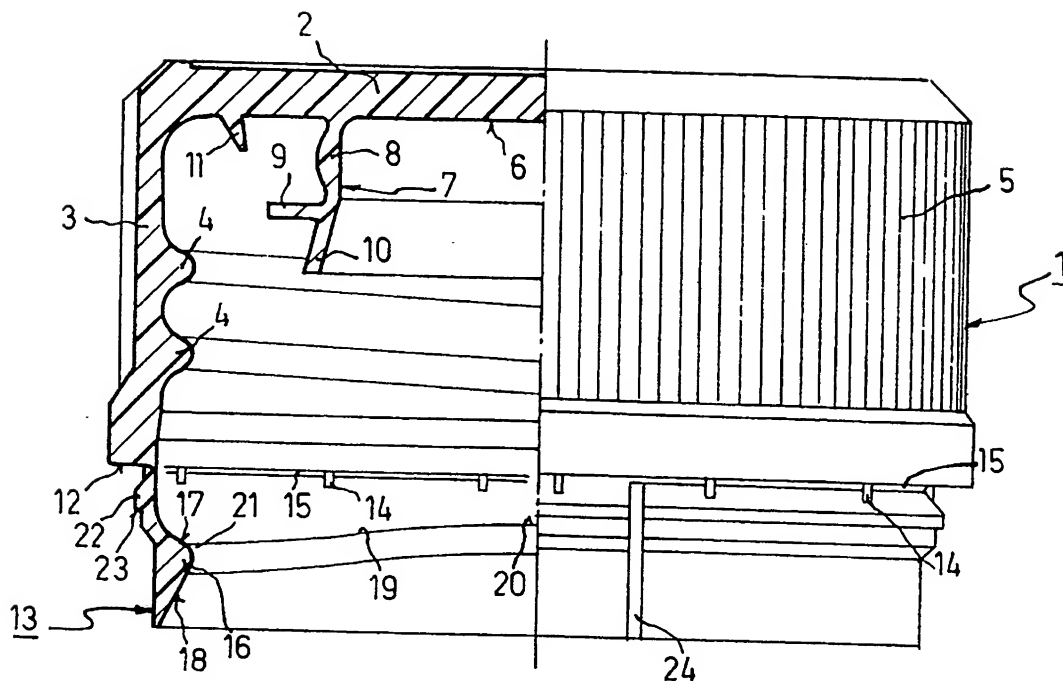
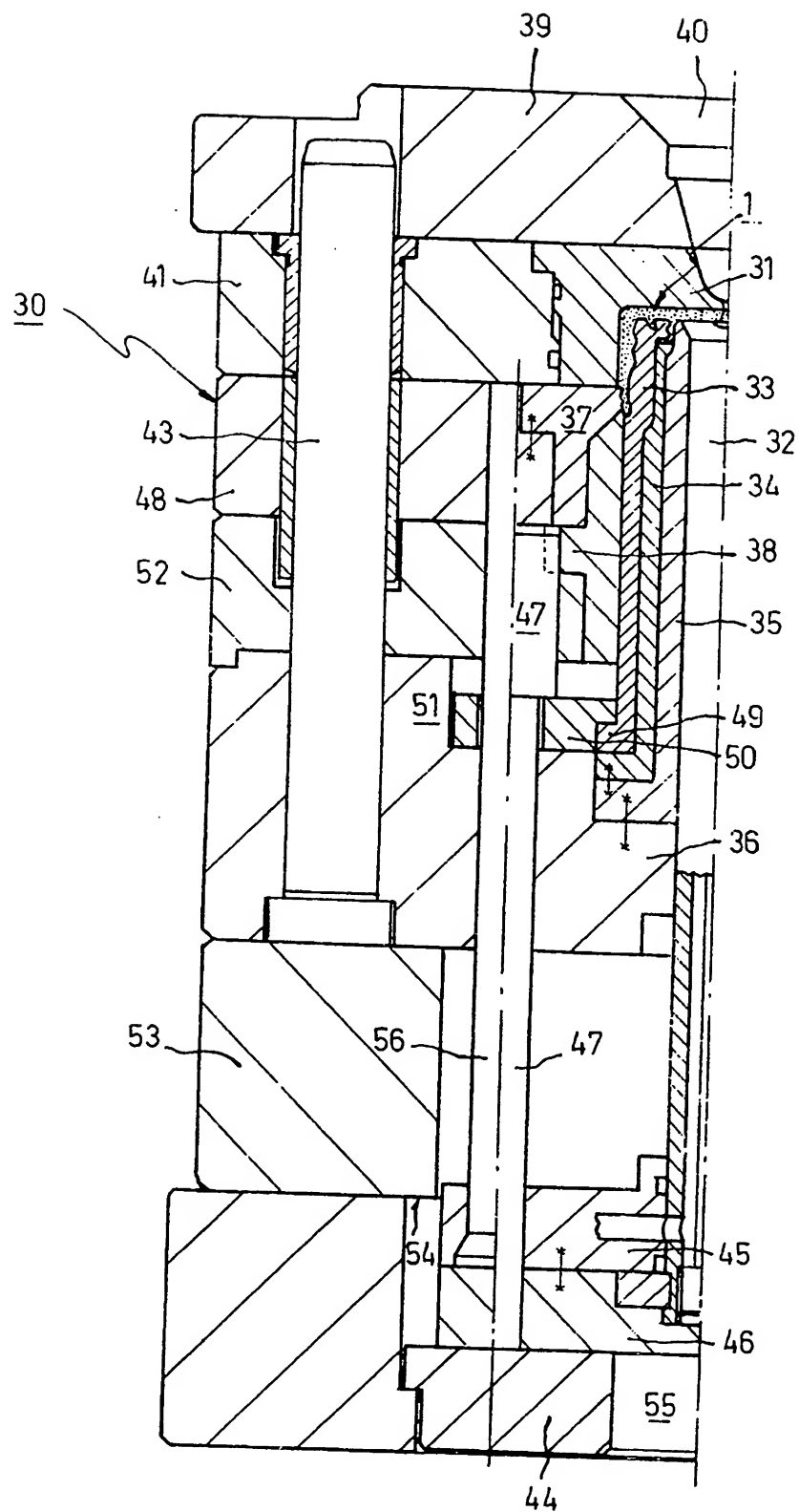
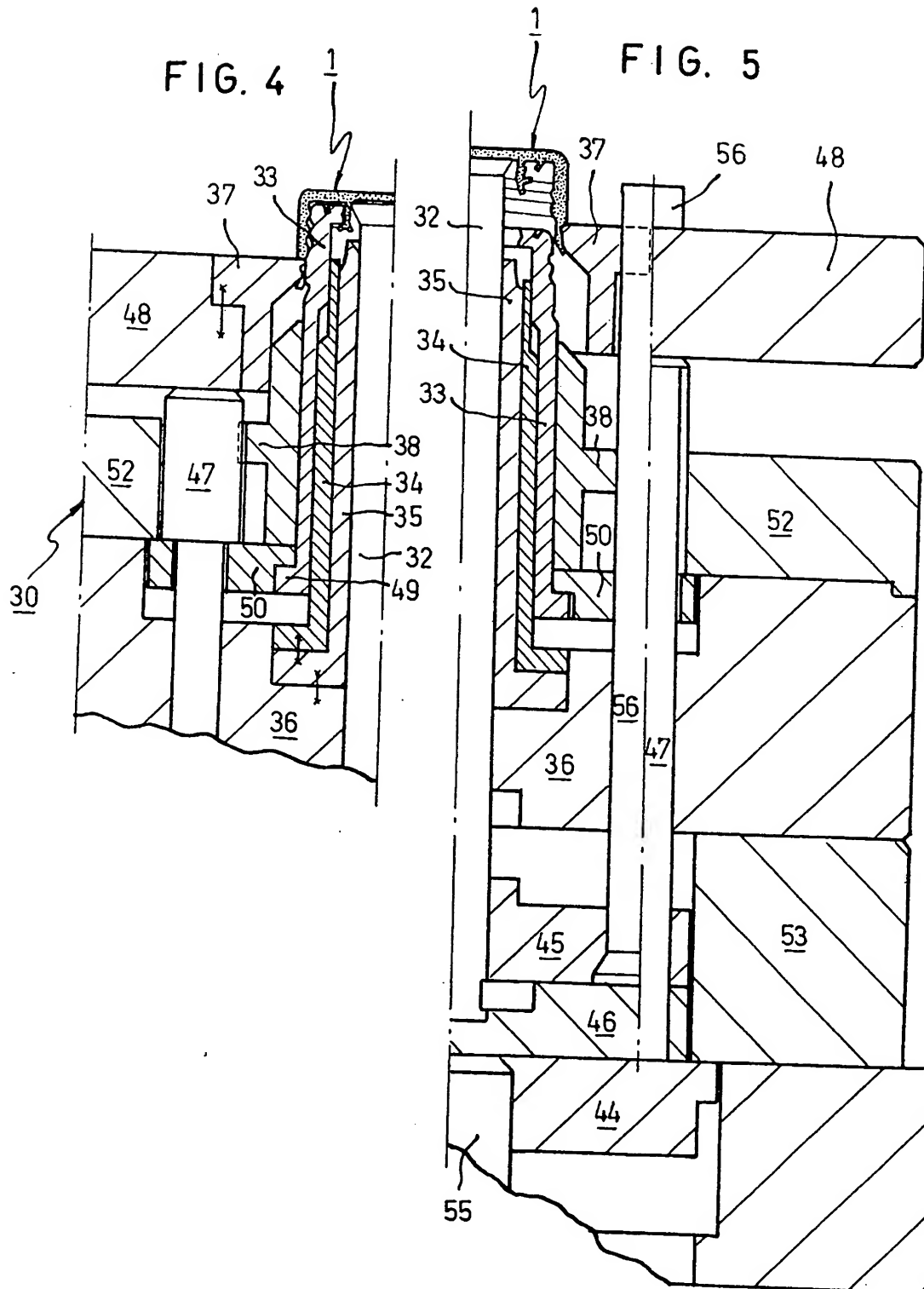


FIG. 2

FIG. 3





SPECIFICATION **Bottle Stopper**

The present invention relates to a plastic screw cap bottle stopper of the type comprising top portion and an internally screw threaded skirt portion especially a flat top portion and a cylindrical skirt portion and preferably having a centered inner sealing portion extending upwardly from the inner surface of the top portion, said sealing portion comprising a portion having essentially the shape of a cylindrical crown, from the free edge of which there extends outwardly an annular flange, the cylindrical skirt portion of the stopper being extended by a security ring portion connected to the skirt portion by a plurality of relatively weak connecting bridge portions, said security ring portion having an internal annular rib.

The currently known screw cap bottle stops of the type disclosed have certain disadvantages, outstanding among which is the fact that it has only been possible to manufacture them by injection moulding using moulds which, to make mould stripping possible, are provided with mould members which are transversally moveable relative to the mould axis.

The presence of such transversally moveable mould members in the mould requires, among other things, a greater space for the mould, thereby greatly limiting the number of moulds which may be fed in a single injection operation and thereby reducing the manufacturing output.

Moreover, in the known screw cap bottle stoppers, when the cap is screwed off the bottle neck, the security ring frequently is not retained on the neck.

In view of the above, an object of the invention is to provide a screw cap bottle stopper overcoming the above disadvantages, namely that its security ring portion should be retained on the bottle neck, that it may be moulded by injection without requiring moulds equipped with transversally moveable elements and that, moreover, it should improve the sealing of the bottle interior as well as guide the cap during the closing operation.

The problem is solved, according to the invention by a screw cap bottle stopper having a top portion and a peripheral internally screw threaded skirt portion, the bottom edge of which is provided with a shoulder to provide a support surface for ejection of the stopper during mould stripping, the skirt being extended by a security ring attached to the skirt by relatively weak connecting bridge portions, the security ring being provided with a shoulder on its outer surface providing a second support surface for ejection of the stopper during mould stripping preferably the portion is provided between the region of the connecting bridge portions and the region corresponding to the internal annular rib thereof with an external shoulder portion the lower surface of which remote from the cylindrical skirt portion is disposed substantially normal to the

screw cap axis, so as to form together with the lower edge of the cylindrical skirt portion a second support surface for ejection of the screw cap from the inner mould portion therefor, so that such dual support avoids the creation of stresses capable to causing rupture of the connecting bridge portions between the skirt portion and the security ring portion during the mould stripping process and in that the inner seal portion, from the point where the cylindrical crown thereof is attached to the annular flange thereof is extended by a diverging frustoconical portion.

In a further development of the invention, the annular rib of the security ring portion is disposed along a wavy line having substantially two peaks and two valleys, each pair being substantially diametrically opposed.

The manufacture by injection moulding of a screw cap bottle stopper of the type described affords serious mould stripping problems, due particularly to the annular rib of the security ring portion, since it must be possible to strip this portion from the mould without any danger of breaking the connecting bridge portions and, therefore, separating the security ring portion from the rest of the screw cap stopper during the mould stripping operation.

The invention relates also to a mould for the manufacture of the disclosed screw cap stoppers by injection moulding.

The mould is of the type having a cavity for forming the screw cap stopper and the parts of the cavity for forming the outer surface of the cap and the outer surface of the cylindrical skirt portion are defined by one or more closing members which are separable from the mould in the lengthwise direction of the mould axis, while the centre circular portion thereof for the inner surface of the screw cap stopper comprised by the inner seal portion is defined by a centre valve member which is also axially moveable.

So as to solve the above problems without having to fall back on the use of moulds having transversally moveable members, a mould of the aforesaid type has been devised, which is fundamentally characterised in that between the remaining members defining the mould cavity, there is: an axially moveable mould crown member, adapted for forming the lower edge of the cylindrical skirt portion of the screw cap stopper and the upper portion of the outer face of the security ring portion, including the shoulder thereof; an axially moveable annular punch having a shorter stroke than that of the mould crown, member, said punch being adapted for shaping the inner surfaces of the cylindrical skirt portion and of the security ring portion, as well as the upper surface of the inner seal crown flange, the outer surface of said crown and the inner surface of the screw cap top comprised between the seal and the skirt portion; and a fixed annular punch, externally adjacent the moving punch, and being adapted for shaping the lower portion of the outer surface of the security ring portion, so that once the screw cap stopper has been injection moulded

in a way known *per se* and after the mould is opened by separating the closing members, the stripping of the screw cap stopper comprises an axial movement of the mould crown member,

- 5 which pushes the screw cap stopper simultaneously by the lower edge of the cylindrical skirt portion and by the security ring shoulder, thereby avoiding stresses in the screw cap capable of causing rupture of the connecting
10 bridge portions between the skirt portion and the security ring portion, the moving annular punch being drawn in said movement to the end of its stroke and the screw cap stopper being separated from said fixed punch externally adjacent said
15 moving punch, whereby, with the lower portion of the outer surface of the security ring portion not being held by said fixed punch, said security ring portion is capable of flexing outwardly, thereby allowing stripping of the internal annular rib of the
20 screw cap from the moving punch.

The invention is described in fuller detail hereinafter, with reference to the accompanying drawings, in which:

- 25 Figure 1 is an elevation view of the screw cap bottle stopper of the invention, with one half being shown in section;

Figure 2 is a sectional view of half of the screw cap stopper in place on a bottle neck;

- 30 Figure 3 is an axial sectional view of one half of an injection mould for a plastics screw cap bottle stopper, shown in the injection position, prior to mould stripping; an extractor and a recoil rod having been shown partly superimposed for better understanding;

- 35 Figure 4 is a view similar to the previous figure, although partial, corresponding to the mould position after the closing members have been opened and the front plate member, the screw cap stopper and the moving punch have been fed
40 forward, the last named to the end of its stroke;

Figure 5 is a view similar to the previous figures, showing the mould position wherein the front plate and the screw cap stopper have continued their forward feed; and

- 45 Figure 6 is a view similar to the previous ones, showing the mould position in which the centre valve has fed forward, causing ejection of the screw cap bottle stopper.

- In the Figures, there is to be seen the screw cap bottle stopper 1, comprising a flat top portion
50 2, which is extended in its periphery by a cylindrical skirt portion 3, internally threaded at 4. Preferably said skirt portion 3 is provided externally with knurling 5, making it easier to hold
55 for the unscrewing and screwing operations.

- From the inner surface 6 of the top portion 2 there extends concentrically with the skirt portion an inner seal portion 7 comprising a generally cylindrical portion 8, an outer annular flange 9
60 and a diverging frustoconical portion 10. An annular rib 11 also extends from the said inner surface 6.

- The lower edge portion 12 of the cylindrical skirt portion 3 is extended by a security ring
65 portion 13, connected to the skirt portion 3 by a

plurality of relatively weak connecting bridge portions 14 between which there are slots 15.

- Said security ring portion 13 is provided internally with an annular rib portion 16, the
70 surface 17 of which closer to the skirt portion 3 is generally normal to the axis of the screw cap bottle stopper so as to be suitably held by the bottle neck as will be described hereinafter. Contrariwise, the surface 18 thereof remote from
75 the skirt portion 3 forms a small angle with the said axis, for the purpose of facilitating the fitting of the screw cap stopper over the neck. Said rib portion is preferably disposed along a wavy line 19 having two peaks 20 and two valleys 21, of
80 which only one peak and one valley are shown in the drawing.

- Between the region of the connecting bridge portions 14 and the region of the annular rib portion 16, the security ring portion 13 is
85 provided with an outer shoulder portion 22, the surface 23 thereof remote from the skirt portion 3 is disposed generally perpendicular to the axis of the screw cap stopper, or forming an acute angle thereto. The security ring portion 13 is also
90 provided with a weakened zone 24, where the ring wall is very thin. In the figures this weakened zone 24 has been shown to be a straight line, although it may also be an oblique line or be of a mixed nature.

- The screw cap stopper 1 is for attachment to the neck 25 of a bottle 26, said neck being provided externally with a thread 27 mating with the thread of the screw cap stopper 1, as well as with a shoulder portion 28, the lower surface 29
100 of which is generally normal to the neck axis.

- When the screw cap stopper 1 is applied to the neck 25, the frustoconical portion 10 of the inner seal portion 7 serves in the first place as a guide member for the screw cap stopper, this being of
105 notable interest, since the neck wall thickness varies frequently according to the bottle manufacturer, there being a range of variability of ± 1.5 mm.

- On starting to screw the cap onto the neck, the
110 screw cap moves down the neck and the disposition of the security ring surface 18 makes it possible for the said security ring portion to move beyond the side surface of the shoulder portion 28 of the neck, by progressive flexion of the security ring outwardly.

- When the cap is fully screwed on the neck, the outer annular flange 9 of the inner seal portion 7, as well as the lower edge of the frustoconical portion 10, are applied against the inside wall of the neck, whereby two annular areas of tight sealing of the inside of the bottle are obtained, thereby notably improving the said sealing, which is very advantageous particularly when the bottle contains beverages having gases dissolved
120 therein. There is also a third sealing area, already known in the prior art, which is the area formed by the application of the annular rib 11 against the top edge of the bottle neck.

- To open the bottle 26, the screw cap is
130 obviously unscrewed, whereby it rises up the

bottle neck until the surface 17 of the annular rib portion 16 engages the lower surface 29 of the shoulder portion 28 of the neck 25, from which time onwards, the unscrewing force is sufficient to rupture the weak connecting bridge portions 14, whereby the screw cap may be removed from the bottle and the security ring portion 13 remains on the neck.

This action is known *per se*, but outstanding is the fact that with the annular rib 16 being disposed essentially along a wavy line, its peaks 20 engage the surface 29 before the rest of the rib 16, whereby as unscrewing of the cap is initiated, only the connecting bridges 14 adjacent the peaks undergo the pulling stress, thereby facilitating the successive rupture thereof and, therefore, improving the possibilities of the security ring portion being retained on the bottle neck.

A further important advantage of the screw cap stopper according to the invention is provided by the existence of the surface 23 of the shoulder portion 22. In fact, said screw cap bottle stopper may be produced by injection moulding in such a way that the connecting bridge portions 14 are not broken during mould stripping. This is due precisely to the fact that said surface 22 constitutes, together with the lower edge portion 12 of the cylindrical skirt portion 3, bearing surfaces for the ejection of the screw cap stopper from its inner mould portion during the said mould stripping operation, so that this dual support prevents stresses capable of rupturing the said connecting bridge portions.

A mould 30 is shown in Figures 3 to 6 in axial section, for injection moulding of the screw cap stopper described above. In this mould, mould members moveable transversally with respect to the mould axis are not required for making stripping possible.

The mould 30 comprises the following members defining the cavity in which the screw cap stopper 1 is formed: the closing member 31 defines the outer surfaces of the top portion 2 and of the cylindrical skirt portion 3; the centre valve member 32 defines the inner centre surface 6 of the top portion 2; the axially moveable annular punch 33 defines the inner peripheral surface of the top portion 2, as well as the outer surface of the cylindrical crown portion 8 of the inner seal portion 7 and the outer surface of the outer annular flange portion 9; the first fixed annular punch 34 defines the outer surface of the frustoconical portion 10 and the lower surface of the flange portion 9, said first punch 34 being concentrically mounted inside the moveable punch 33 and in contact therewith; the second fixed annular punch 35, fixedly attached to the first punch and adjacent and concentric thereto and in turn fixedly attached to a fixed plate 36, defines the inner surface of the cylindrical crown portion 8 and of the frustoconical portion 10; the mould crown member 37 is provided with a mould surface capable of forming the lower transversal edge portion 12 of the cylindrical skirt

portion 3 and the upper portion of the outer face of the security ring portion 13, particularly the surface 23 of the shoulder portion 22; the third fixed annular punch 38, mounted concentrically around the moveable punch 33 and adjacent thereto, defines the lower portion of the outer surface of the security ring portion 13.

The mould 30 also comprises the upper closing member 39 provided with a port 40 through which the plastics material for the manufacture of the screw cap stopper is supplied. In turn, the closing member 31 is fixedly attached to the crown member 41, the closing members 31 and 39 and crown member 41 being obviously separable to allow stripping of the screw cap stopper 1 after the formation thereof, this separation being made possible by the orifice 42, in which a guide pin 43 is housed.

At the rear end of the mould 30, there is the rear plate member 44 adapted for movement in the direction of the mould axis, during which movement it pushes the intermediate plate members 45 and 46 fixedly attached to one another, and also the ejectors 47, of which there may be three or more, preferably disposed symmetrically around the axis of the mould.

The front plate member 48 is moved in turn by the ejectors 47, plate member 48 being fixedly attached to the mould crown member 37.

In turn, the moving punch 33 is provided at the rear portion thereof with an annular flange 49 with which it may draw the ring 50 in its movement. The forward movement of the ring 50 is limited by the rear surface 51 of the abutment plate member 52, which is fixedly attached to the third fixed punch member 38. In turn, a second fixed abutment plate member 53 is capable of constituting by way of its rear surface 54 a stop for the forward movement of the rear plate member 44. As is known, the centre valve member 32 is adapted to be moved by the hydraulic ejector 55 of the machine, for the purpose of being considerably displaced in the axial direction forwards to finish the ejection of the screw cap stopper 1.

The recoil rods 56 kinematically connect the closing member 41 with the intermediate plate members 45 and 46 and the rear plate member 44, whereby they allow the initial position of the mould to be recovered when reclosing it. In Figures 3, 5 and 6, the said recoil rods have been illustrated partly superimposed over the ejectors 47, although in the mould itself, the recoil rods and ejectors are located on different diametral planes.

In Figure 3 there is shown the relative position of the mould members after having injection moulded a plastic screw cap bottle stopper 1; the delimitation of all the surface of the screw cap by the corresponding mould members is to be observed.

In order to strip the screw cap stopper from the mould, the following sequence of operations is used: the mould 30 is opened, by separating the upper closing member 39, as well as the crown

member 41 and therewith the closing member 31, attached thereto not illustrated in Figures 4, 5 and 6.

In the position illustrated in Figure 4, the rear plate member 44 has been moved forwards and therewith the intermediate plate members 45 and 46 attached thereto (not illustrated in this Figure), as well as the ejectors 47, which have in turn pushed the front plate member 48 and, consequently, the mould crown member 37 fixedly attached thereto. Likewise the centre valve member 32 has moved forwards.

The movement of the mould crown member 37 and of the centre valve member 32 takes with it the screw cap stopper itself. Since the mould crown member 37 simultaneously pushes the screw cap stopper by means of the lower edge portion 12 of the cylindrical skirt portion 3 and the surface 23 of the security ring portion 13, no stress is caused between the skirt portion and the security ring portion which could cause rupture of the connecting bridge portions 14, the screw cap stopper thereby being ejected intact from the mould.

As it moves forward, the screw cap stopper draws with it the moving punch 33 which slides between the first fixed punch 34 and the third fixed punch 38. Therewith, the lower portion of the outer surface of the security ring portion 13 ceases to be enclosed by the third punch 38 and thus said security ring portion 13 may be stripped from the mould since it may flex outwardly and the annular rib portion 16 may be freed from the corresponding cavity of the punch 33. This punch 33 continues to move until the ring 50 abuts the rear surface 51 of the abutment plate member 52 and since the mould crown member 37 and the valve member 32 continue moving, with the moving punch 33 restrained from movement, the separation of said screw cap stopper 1 from the punch 33 is initiated.

Figure 5 shows a further position of the mould 30, corresponding to a further forward movement of the crown member 37 and valve member 32, consequent to a movement forward of the rear plate member 44 until the latter abuts the rear surface 54 of the second abutment plate member 53. At this time the screw cap stopper 1 is practically stripped from the mould, the inner seal portion 7 having been stripped by flexion thereof towards the inside of the screw cap stopper, on removal of the surfaces of said inner seal portion from the fixed punches 34 and 35.

Figure 6 shows the ejected position of the screw cap stopper 1, in which the front plate member 48 and the mould crown member 37 have been restrained from further movement by the abutment of the rear plate member 44 with the second abutment plate member 53, while due to the action of the hydraulic ejector 55 of the machine, the intermediate plate members 45 and 46 and, therewith, the centre valve member 32 which, by an air jet causes removal of the screw cap stopper 1 from the mould 30, are caused to continue forwards.

Claims

1. A plastics screw cap bottle stopper having a top portion and a peripheral internally screw threaded skirt portion, the bottom edge of which is provided with a shoulder to provide a support surface for ejection of the stopper during mould stripping, the skirt being extended by a security ring attached to the skirt by relatively weak connecting bridge portions, the security ring being provided with a shoulder on its outer surface providing a second support surface for ejection of the stopper during mould stripping.

2. A bottle stopper as claimed in claim 1 having a flat top portion and a peripheral cylindrical skirt portion.

3. A bottle stopper as claimed in claim 1 or claim 2 having a centred inner sealing portion on the inner surface of the top portion of the stopper.

4. A bottle stopper as claimed in claim 3, wherein the sealing portion comprises a portion having essentially the shape of the cylindrical crown, from the free edge of which there extends outwardly an annular flange.

5. A bottle stopper as claimed in any of claims 1 to 4, wherein the security ring has an internal annular rib.

6. A bottle stopper as claimed in claim 5, wherein the annular rib is disposed in a wavy line having diametrically opposed peaks and valleys.

7. A bottle stopper as claimed in claim 6, wherein there are two peaks and two valleys.

8. A plastics screw cap bottle stopper of the type comprising a flat top portion which is provided with a peripheral cylindrical skirt portion having an internal screw thread and comprising a centered inner sealing portion extending upwardly from the inner surface of the top portion, said sealing portion comprising a portion having essentially the shape of a cylindrical crown, from the free edge of which there extends outwardly an annular flange, the cylindrical skirt portion of the stopper being extended by a security ring portion connected to the skirt portion by a plurality of relatively weak connecting bridge portions, said security ring portion having an inner annular rib, characterised in that the security ring portion is provided between the region of the connecting bridge portions and the region corresponding to the inner annular rib thereof with an outer shoulder portion the lower surface of which remote from the cylindrical skirt portion is disposed substantially normal to the screw cap axis so as to form together with the lower edge of the cylindrical skirt portion, a second support surface for ejection of the screw cap from the inner mould portion therefor, so that such dual support avoids the creation of stresses capable of causing rupture of the connecting bridge portions between the skirt portion and the security ring portion in the mould stripping process and in that the inner seal portion, from the point where the cylindrical crown portion thereof is attached to the annular flange thereof is extended by a diverging frustoconical portion.

9. A bottle stopper substantially as described

herein with reference to and as shown in Figs. 1 and 2 of the drawings.

10. A mould for the injection moulding of a screw cap bottle stopper as claimed in claim 1, said mould being provided with ejector means for simultaneously engaging the shoulder on the skirt of the stopper and the shoulder on the security ring for ejection of the stopper from the mould without fracture of the connecting bridge portions between the skirt portion and the security ring.

11. A mould as claimed in claim 10, the mould being of the type having a cavity for forming the screw cap stopper and the parts of the cavity for forming the outer surface of the flat top portion and the outer surface of the cylindrical skirt portion being defined by one or more closing members which are separable from the mould in the lengthwise direction of the mould axis, while the centre circular portion thereof for the inner surface of the screw cap comprised by the inner seal portion is defined by a centre valve member also axially moveable, characterised in that between the remaining mould members defining the mould cavity there is: an axially moveable mould crown member adapted for forming the lower edge of the cylindrical skirt portion of the screw cap bottle stopper and the upper portion of the outer surface of the security ring portion, including the shoulder thereof; an axially moveable annular punch having a shorter stroke than that of the mould crown member, said punch being adapted for shaping the inner surfaces of the cylindrical skirt portion and security ring portion, as well as the upper surface of the inner

seal crown flange, the outer surface of said crown portion and the lower surface of the flat top portion comprised between the inner seal portion and the skirt portion; and a fixed annular punch, externally adjacent the moving punch, and being adapted for shaping the lower portion of the outer surface of the security ring portion, so that once the screw cap bottle stopper has been injection moulded in a way known *per se* and after the mould is opened by separating the closing members, the stripping of the screw cap stopper comprises an axial movement of the mould crown member which pushes the screw cap stopper simultaneously by the lower edge of the cylindrical skirt portion and by the security ring portion shoulder, thereby avoiding stresses in the screw cap capable of causing rupture of the connecting bridge portions between the skirt portion and the security ring portion, the moving annular punch being drawn in said movement to the end of the stroke thereof and the screw cap stopper being separated from said fixed punch externally adjacent said moving punch, whereby, with the lower portion of the outer surface the security ring portion not being held by said fixed punch, said security ring portion is capable of flexing outwardly, thereby allowing stripping of the internal annular rib of the screw cap from said moving punch.

12. A mould as claimed in claim 10 constructed substantially as described herein with reference to and as shown in Figs. 3 to 6 of the drawings.